

Amendments to the Drawings:

The attached 3 replacement sheets of drawings include changes to Figs. 39-41. Per the Examiner's request, the legend "Prior Art" has been added to Figs. 39-41. These replacement sheets replace the original sheets including Fig. 39-41, respectively.

Attachment: Replacement Sheets (3)

REMARKS

Pursuant to 37 CFR § 1.215(a), Applicants are submitting a Substitute Specification. No new matter has been added.

The Figures 39 to 41 have been designated by a legend -- Prior Art --.

The phrase "coordination system" used in the specification has been replaced as clerical error with "coordinate system".

The specification has been amended so as to include a description of each acronym (CPU, RAM, ROM and the like).

The title "SPCIFICATION" of the specification has been replaced as clerical error with "SPECIFICATION".

The word "coordination system" of claims 3, 8-12, and 19-21 has been replaced as clerical error with "coordinate system". The word "inductive" of claims 19-22 has been replaced as clerical error with "indicative". The phrase "marker located" of claim 10 has been replaced as clerical error with "marker is located".

Claims 15 and 16 has been amended so as not to depend on any other multiple dependent claim.

In response to the item 9 of the Office Action, claims 1 and 17 have been cancelled.

In response to the item 10 of the Office Action, claims 23-27 have been cancelled as being directed to non-statutory subject matter.

In response to the item 12 of the Office Action, claims 2 and 18 have been cancelled.

The present invention defined in currently amended claim 3 is patentably distinguishable over Atsushi et al (JP2001-116515) and Tanaka (US6,201,882) by the following reasons.

The constituent features of the camera calibrating apparatus defined in currently amended claim 3 are as follows:

(3a) first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located;

(3b) second housing position information storing means for storing second housing position information indicative of a position of the housing unit in the second coordinate system in which a calibrating marker is located;

(3c) first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device;

- (3d) first optical position information storing means for storing the first optical position information produced by the first optical position information producing means;
- (3e) second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means;
- (3f) estimated position information producing means for producing estimated position information indicative of a position of the calibrating marker to an image coordinate system of the imaging device on the basis of the second optical position information produced by the second optical position information producing means;
- (3g) second optical position information storing means for storing the second optical position information produced by the second optical position information producing means;
- (3h) estimated position information storing means for storing the estimated position information produced by the estimated position information producing means; and
- (3i) calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of the image information of the calibrating marker obtained by the imaging device and the estimated position information stored by the estimated position information storing means.

In the camera calibrating apparatus according to the present invention, the first housing position information indicative of a position of the housing unit is firstly obtained in the first coordinate system. Then, the first optical position information producing means produces first optical position information indicative of a position of the optical section in the first coordinate system. On the other hand, the second optical position information producing means produces second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information on the basis of the first housing position information and the first optical position information. The calibrating means calibrates the second optical position information on the basis of the image information of the calibrating marker and the estimated position information.

The camera calibrating apparatus according to the present invention can (i) calibrate optical parameters of the optical section of the imaging device mounted on the automotive vehicle or the like, and can (ii) improve an assembling process in which the imaging device is attached to the automotive vehicle or other object.

When, for example, imaging devices are attached to respective automotive vehicles, it is

difficult to locate the each imaging device in a designed position with accuracy, and without increasing the number of man-hour at the time of attaching the imaging device to the automotive vehicle. Even if the imaging device is correctly attached to the automotive vehicle, it is difficult to have the imaging device take an image of a specific object such as a bumper or the like with accuracy, resulting from the fact that the imaging device has optical parameters which are not necessarily be the same as designed values.

In the conventional apparatus, an image to be taken by the imaging device attached to the automotive vehicle tends to be greatly affected by the individual difference of the imaging device and the position of the imaging device attached to the automotive vehicle. However, the camera calibrating apparatus defined by the currently amended claim 3 can further obtain the following advantageous effects.

(iii) The first optical position information can be calculated from the image information of the revising marker obtained by the imaging device. In other words, the individual difference of the imaging device can be calculated from the image information of the revising marker obtained by the imaging device.

(iv) The estimated position information can be calculated from the second optical position information produced by the second optical position information producing means. In other words, the position of the calibrating marker to an image coordinate system can be estimated from the individual difference of the imaging device.

(v) The second optical position information can be calibrated on the basis of the image information of the calibrating marker and the estimated position information without being affected by the real position of the imaging device attached to the automotive vehicle.

(vi) When the imaging device attached to the automotive vehicle is used by a user, an image of a specific object such as a bumper or the like can be correctly obtained from an image taken by the imaging device attached to the automotive vehicle on the basis of the calibrated second optical position information without being affected by the position of the imaging device attached to the automotive vehicle.

Tanaka (US6,201,882) discloses a camera calibration apparatus which eliminates the necessity to effect mapping making a distinction among a plurality of characteristic points and can prevent complication in mapping processing even if the number of characteristic points increases, and in which an object imaging section images a sphere whose magnitude and position in a three-dimensional coordinate system are known, and a magnitude/position detection section determines a magnitude and a position of the sphere on a screen from an image imaged by the object imaging section, a center position estimation section estimates a three-dimensional

position of the center of the sphere from the magnitude and the position of the sphere on the screen determined by the magnitude/position detection section, and a parameter calculation section calculates a position of the object imaging section in the three-dimensional coordinate system based on the three-dimensional position of the center of the sphere estimated by the center position estimation section.

Tanaka (US6,201,882), however, fails to teach and suggest a camera calibrating apparatus comprising: first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; second housing position information storing means for storing second housing position information indicative of a position of the housing unit in the second coordinate system in which a calibrating marker is located; first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; first optical position information storing means for storing the first optical position information produced by the first optical position information producing means; second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means; estimated position information producing means for producing estimated position information indicative of a position of the calibrating marker to an image coordinate system of the imaging device on the basis of the second optical position information produced by the second optical position information producing means; second optical position information storing means for storing the second optical position information produced by the second optical position information producing means; estimated position information storing means for storing the estimated position information produced by the estimated position information producing means; and calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of the image information of the calibrating marker obtained by the imaging device and the estimated position information stored by the estimated position information storing means.

The camera calibrating apparatus defined in currently amended claim 3 is completely different in construction from the camera calibration apparatus disclosed by Tanaka (US6,201,882).

The camera calibration apparatus disclosed by Tanaka (US6,201,882) cannot expect the above-mentioned advantageous effects (i) to (vi).

Atsushi et al (JP2001-116515) discloses a calibration method eliminating the need to adjust the optical axis of an image pickup device and makes it possible to fit the same image pickup device and image processor to a vehicle which is different in the fitting height and angle of the image pickup device when the image pickup device is fitted to the vehicle so as to automatically measure and use the installation state of the image pickup device for the operation of the image processor.

Atsushi et al (JP2001-116515), however, fails to teach and suggest a camera calibrating apparatus comprising: first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; second housing position information storing means for storing second housing position information indicative of a position of the housing unit in the second coordinate system in which a calibrating marker is located; first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; first optical position information storing means for storing the first optical position information produced by the first optical position information producing means; second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means; estimated position information producing means for producing estimated position information indicative of a position of the calibrating marker to an image coordinate system of the imaging device on the basis of the second optical position information produced by the second optical position information producing means; second optical position information storing means for storing the second optical position information produced by the second optical position information producing means; estimated position information storing means for storing the estimated position information produced by the estimated position information producing means; and calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of the image information of the calibrating marker obtained by the imaging device and the estimated position information stored by the estimated position information storing means.

The camera calibrating apparatus defined in currently amended claim 3 is completely different in construction from the calibration method disclosed by Atsushi et al (JP2001-116515).

The calibration method disclosed by Atsushi et al (JP2001-116515) cannot expect the above-mentioned advantageous effects (i) to (vi).

It will, therefore, be appreciated from the foregoing description that the camera calibrating apparatus defined in currently amended claim 3 is patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 4 depends from claim 3 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 5 depends from claim 4 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 6 depends from claim 4 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 7 depends from claim 4 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

The present invention defined in currently amended claim 8 is patentably distinguishable over Atsushi et al (JP2001-116515) and Tanaka (US6,201,882) by the following reasons.

The constituent features of the camera calibrating apparatus defined in currently amended claim 8 are as follows:

- (8a) first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located;
- (8b) second housing position information storing means for storing second housing position information indicative of a position of the housing unit in the second coordinate system;
- (8c) first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information obtained by the imaging device and indicative of the revising marker;
- (8d) first optical position information storing means for storing the first optical position information produced by the first optical position information producing means;
- (8e) second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position

information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means;

(8f) second optical position information storing means for storing the second optical position information produced by the second optical position information producing means; and

(8g) calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of a motion vector of the image information obtained by the imaging device in the second coordinate system.

Tanaka (US6,201,882) fails to teach and suggest a camera calibrating apparatus comprising: first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; second housing position information storing means for storing second housing position information indicative of a position of the housing unit in the second coordinate system; first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information obtained by the imaging device and indicative of the revising marker; first optical position information storing means for storing the first optical position information produced by the first optical position information producing means; second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means; second optical position information storing means for storing the second optical position information produced by the second optical position information producing means; and calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of a motion vector of the image information obtained by the imaging device in the second coordinate system.

The camera calibrating apparatus defined in currently amended claim 8 is completely different in construction from the camera calibration apparatus disclosed by Tanaka (US6,201,882).

Atsushi et al (JP2001-116515) fail to teach and suggest a camera calibrating apparatus comprising: first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; second housing position information storing means for storing second

housing position information indicative of a position of the housing unit in the second coordinate system; first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information obtained by the imaging device and indicative of the revising marker; first optical position information storing means for storing the first optical position information produced by the first optical position information producing means; second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means; second optical position information storing means for storing the second optical position information produced by the second optical position information producing means; and calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of a motion vector of the image information obtained by the imaging device in the second coordinate system.

The camera calibrating apparatus defined in currently amended claim 8 is completely different in construction from the calibration method disclosed by Atsushi et al (JP2001-116515).

It will, therefore, be appreciated from the foregoing description that the camera calibrating apparatus defined in currently amended claim 8 is patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 9 depends from claim 8 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 10 depends from claim 8 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

The present invention defined in currently amended claim 11 is patentably distinguishable over Atsushi et al (JP2001-116515) and Tanaka (US6,201,882) by the following reasons.

The constituent features of the camera calibrating apparatus defined in currently amended claim 11 are as follows:

(11a) first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located;

(11a) second housing position information storing means for storing second housing position

information indicative of a position of the housing unit in the second coordinate system in which an automotive vehicle is located;

(11a) first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device;

(11a) first optical position information storing means for storing the first optical position information produced by the first optical position information producing means;

(11a) second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means;

(11a) estimated position information producing means for producing estimated position information indicative of a position of the automotive vehicle to an image coordinate system of the imaging device on the basis of the second optical position information produced by the second optical position information producing means;

(11a) second optical position information storing means for storing the second optical position information produced by the second optical position information producing means;

(11a) estimated position information storing means for storing the estimated position information produced by the estimated position information estimating means; and

(11a) calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of the image information of the automotive vehicle obtained by the imaging device and the estimated position information stored by the estimated position information storing means.

Tanaka (US6,201,882) fails to teach and suggest a camera calibrating apparatus comprising: first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; second housing position information storing means for storing second housing position information indicative of a position of the housing unit in the second coordinate system in which an automotive vehicle is located; first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; first optical position information storing means for storing the first optical position information produced by the first optical position information producing

means; second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored by the first optical position information storing means; estimated position information producing means for producing estimated position information indicative of a position of the automotive vehicle to an image coordinate system of the imaging device on the basis of the second optical position information produced by the second optical position information producing means; second optical position information storing means for storing the second optical position information produced by the second optical position information producing means; estimated position information storing means for storing the estimated position information produced by the estimated position information estimating means; and calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of the image information of the automotive vehicle obtained by the imaging device and the estimated position information stored by the estimated position information storing means.

The camera calibrating apparatus defined in currently amended claim 11 is completely different in construction from the camera calibration apparatus disclosed by Tanaka (US6,201,882).

Atsushi et al (JP2001-116515) fail to teach and suggest a camera calibrating apparatus comprising: first housing position information storing means for storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; second housing position information storing means for storing second housing position information indicative of a position of the housing unit in the second coordinate system in which an automotive vehicle is located; first optical position information producing means for producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; first optical position information storing means for storing the first optical position information produced by the first optical position information producing means; second optical position information producing means for producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored by the second housing position information storing means on the basis of the first housing position information stored by the first housing position information storing means and the first optical position information stored

by the first optical position information storing means; estimated position information producing means for producing estimated position information indicative of a position of the automotive vehicle to an image coordinate system of the imaging device on the basis of the second optical position information produced by the second optical position information producing means; second optical position information storing means for storing the second optical position information produced by the second optical position information producing means; estimated position information storing means for storing the estimated position information produced by the estimated position information estimating means; and calibrating means for calibrating the second optical position information stored by the second optical position information storing means on the basis of the image information of the automotive vehicle obtained by the imaging device and the estimated position information stored by the estimated position information storing means.

The camera calibrating apparatus defined in currently amended claim 11 is completely different in construction from the calibration method disclosed by Atsushi et al (JP2001-116515).

It will, therefore, be appreciated from the foregoing description that the camera calibrating apparatus defined in currently amended claim 11 is patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 12 depends from claim 11 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

Claim 13 depends from claim 11 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

The present invention defined in currently amended claim 19 is patentably distinguishable over Atsushi et al (JP2001-116515) and Tanaka (US6,201,882) by the following reasons.

The constituent features of the camera calibrating method defined in currently amended claim 19 are as follows:

- (19a) a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located;
- (19b) a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system in which a calibrating marker is located;
- (19c) a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the

basis of the image information of the revising marker obtained by the imaging device;

(19d) a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step;

(19e) a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step;

(19f) an estimated position information producing step of producing estimated position information indicative of a position of the calibrating marker to an image coordinate system of the imaging device on the basis of the second optical position information produced in the second optical position information producing step;

(19g) a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step;

(19h) an estimated position information storing step of storing the estimated position information produced in the estimated position information producing step; and

(19i) a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of the image information of the calibrating marker obtained by the imaging device and the estimated position information stored in the estimated position information storing step.

Tanaka (US6,201,882) fails to teach and suggest a camera calibrating method comprising: a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system in which a calibrating marker is located; a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step; a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing

position information storing step and the first optical position information stored in the first optical position information storing step; an estimated position information producing step of producing estimated position information indicative of a position of the calibrating marker to an image coordinate system of the imaging device on the basis of the second optical position information produced in the second optical position information producing step; a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step; an estimated position information storing step of storing the estimated position information produced in the estimated position information producing step; and a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of the image information of the calibrating marker obtained by the imaging device and the estimated position information stored in the estimated position information storing step.

The camera calibrating method defined in currently amended claim 19 is completely different in construction from the camera calibration apparatus disclosed by Tanaka (US6,201,882).

Atsushi et al (JP2001-116515) fail to teach and suggest a camera calibrating method comprising: a camera calibrating method comprising: a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system in which a calibrating marker is located; a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step; a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step; an estimated position information producing step of producing estimated position information indicative of a position of the calibrating marker to an image coordinate system of the imaging device on the basis of the second optical position information produced in the second optical position information producing step; a second optical position information storing step of storing the second optical

position information produced in the second optical position information producing step; an estimated position information storing step of storing the estimated position information produced in the estimated position information producing step; and a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of the image information of the calibrating marker obtained by the imaging device and the estimated position information stored in the estimated position information storing step.

The camera calibrating method defined in currently amended claim 19 is completely different in construction from the calibration method disclosed by Atsushi et al (JP2001-116515).

It will, therefore, be appreciated from the foregoing description that the camera calibrating method defined in currently amended claim 19 is patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

The present invention defined in currently amended claim 20 is patentably distinguishable over Atsushi et al (JP2001-116515) and Tanaka (US6,201,882) by the following reasons.

The constituent features of the camera calibrating method defined in currently amended claim 20 are as follows:

- (20a) a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located;
- (20b) a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system;
- (20c) a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information obtained by the imaging device and indicative of the revising marker;
- (20d) a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step;
- (20e) a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step;

(20f) a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step; and

(20g) a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of a motion vector of the image information obtained by the imaging device in the second coordinate system.

Tanaka (US6,201,882) fails to teach and suggest a camera calibrating method comprising: a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system; a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information obtained by the imaging device and indicative of the revising marker; a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step; a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step; a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step; and a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of a motion vector of the image information obtained by the imaging device in the second coordinate system.

The camera calibrating method defined in currently amended claim 20 is completely different in construction from the camera calibration apparatus disclosed by Tanaka (US6,201,882).

Atsushi et al (JP2001-116515) fail to teach and suggest a camera calibrating method comprising: a camera calibrating method comprising: a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system; a first optical position information producing step of producing first optical position information indicative of a position of the

optical section in the first coordinate system on the basis of the image information obtained by the imaging device and indicative of the revising marker; a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step; a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step; a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step; and a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of a motion vector of the image information obtained by the imaging device in the second coordinate system.

The camera calibrating method defined in currently amended claim 20 is completely different in construction from the calibration method disclosed by Atsushi et al (JP2001-116515).

It will, therefore, be appreciated from the foregoing description that the camera calibrating method defined in currently amended claim 20 is patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

The present invention defined in currently amended claim 21 is patentably distinguishable over Atsushi et al (JP2001-116515) and Tanaka (US6,201,882) by the following reasons.

The constituent features of the camera calibrating method defined in currently amended claim 21 are as follows:

- (21a) a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located;
- (21b) a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system in which an automotive vehicle is located;
- (21c) a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device;
- (21d) a first optical position information storing step of storing the first optical position

information produced in the first optical position information producing step;

(21e) a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step;

(21f) an estimated position information producing step of producing estimated position information indicative of a position of the automotive vehicle to an image coordinate system of the imaging device on the basis of the second optical position information produced in the second optical position information producing step;

(21g) a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step;

(21h) an estimated position information storing step of storing the estimated position information produced in the estimated position information producing step; and

(21i) a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of the image information of the automotive vehicle obtained by the imaging device and the estimated position information stored in the estimated position information storing step.

Tanaka (US6,201,882) fails to teach and suggest a camera calibrating method comprising: a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system in which an automotive vehicle is located; a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step; a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step; an estimated position information producing step of

producing estimated position information indicative of a position of the automotive vehicle to an image coordinate system of the imaging device on the basis of the second optical position information produced in the second optical position information producing step; a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step; an estimated position information storing step of storing the estimated position information produced in the estimated position information producing step; and a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of the image information of the automotive vehicle obtained by the imaging device and the estimated position information stored in the estimated position information storing step.

The camera calibrating method defined in currently amended claim 21 is completely different in construction from the camera calibration apparatus disclosed by Tanaka (US6,201,882).

Atsushi et al (JP2001-116515) fail to teach and suggest a camera calibrating method comprising: a camera calibrating method comprising: a first housing position information storing step of storing first housing position information indicative of a position of the housing unit in the first coordinate system in which a revising marker is located; a second housing position information storing step of storing second housing position information indicative of a position of the housing unit in the second coordinate system in which an automotive vehicle is located; a first optical position information producing step of producing first optical position information indicative of a position of the optical section in the first coordinate system on the basis of the image information of the revising marker obtained by the imaging device; a first optical position information storing step of storing the first optical position information produced in the first optical position information producing step; a second optical position information producing step of producing second optical position information indicative of a position of the optical section to the second coordinate system from the second housing position information stored in the second housing position information storing step on the basis of the first housing position information stored in the first housing position information storing step and the first optical position information stored in the first optical position information storing step; an estimated position information producing step of producing estimated position information indicative of a position of the automotive vehicle to an image coordinate system of the imaging device on the basis of the second optical position information produced in the second optical position information producing step; a second optical position information storing step of storing the second optical position information produced in the second optical position information producing step; an estimated position information storing step of storing the estimated position information

produced in the estimated position information estimating step; and a calibrating step of calibrating the second optical position information stored in the second optical position information storing step on the basis of the image information of the automotive vehicle obtained by the imaging device and the estimated position information stored in the estimated position information storing step.

The camera calibrating method defined in currently amended claim 21 is completely different in construction from the calibration method disclosed by Atsushi et al (JP2001-116515).

It will, therefore, be appreciated from the foregoing description that the camera calibrating method defined in currently amended claim 21 is patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

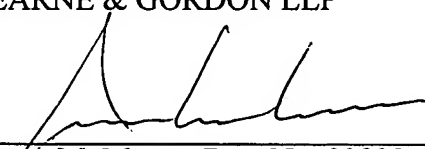
Claim 22 depends from any one of claims 19-21 which is believed to be patentably distinguishable over the disclosure of Atsushi et al (JP2001-116515) and Tanaka (US6,201,882).

In view of the foregoing description, it is respectfully submitted that the present application is thus in condition for allowance.

If any fees are required by this communication which are not covered by an enclosed check, please charge such fees to our Deposit Account No. 16-0820, Order No. ARI 37121.

Respectfully submitted,

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